Nutrient Cycling by Seagrasses and their Epiphytic Consortium in Florida Bay: Experimental Research in Support of a Seagrass Ecosystem Model

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Although seagrasses and epiphytes are known to sequester nutrients from the water column of estuaries, we currently have a limited understanding of seagrass nutrient uptake kinetics and cycling from oligotrophic subtropical estuaries such as Florida (FL) Bay. This is particularly true for P. A recent review of N and P metabolism in seagrasses highlight the major gap in our understanding of P kinetics in seagrasses. Bridging this information gap is critical for the authors efforts to develop a seagrass ecosystem model to test the effects of Everglades restoration in FL Bay ecology. P has been shown to limit seagrass production in eastern FL Bay and therefore must be incorporated into seagrass water quality models. Dissolved organic matter (DOM) and associated nutrients will increase in FL Bay with Everglades restoration. Based on preliminary experiments, this DOM appears to readily photooxidize. P availability may influence uptake of the "new" nutrients. Thus, a research emphasis on seagrass P cycling as well as understanding the coupling between P and N uptake by seagrasses and their epiphytic consortium is warranted and is the focus of our proposed research.

The research objectives are: (1) quantify seagrass and epiphyte P uptake kinetics in the field using low in situ P concentrations across the east-west N:P gradient in the Bay, (2) establish the importance of P availability in N sequestration by seagrasses, (3) examine the ability of seagrasses and their epiphytic consortium to take up nutrients (TN and TP) released from photooxidized DOM expected to increase with Everglades restoration, (4) establish whether seagrass roots can compete with carbonate sediments for porewater P, (5) determine if this sediment P can be translocated to leaves and epiphytes, and (6) incorporate nutrient kinetic data and patterns of nutrient uptake and translocation into a seagrass ecosystem model to predict Everglades restoration effects on FL Bay ecology.

We will conduct P uptake experiments across a low range of P concentrations (ambient ~0.05 to 2 uM) using seagrass leaf-epiphyte chambers in the field. Nitrogen uptake rates will also be determined in the chambers under high and low P levels. The bioavailability of N and P from the Everglades DOM after photooxidation will also be investigated using chambers in the field. In microcosms, we will use 32P to quantify translocation of P from roots to shoots and the epiphytic consortium. 32P will also be used to assess the bioavailability of sediment absorbed P to seagrass roots. Finally, we will utilize these field and experimental data to provide parameters and calibration data for a seagrass mechanistic, process-based model.